B 739/984

Preprint from the 1984

BUREAU OF MINES MINERALS YEARBOOK

The Mineral Industry of Brazil

NEWARK PUBLIC LIBRARY

FEB 29 1988

U. S. GOVT. PUBS.
DEPOSITORY 376

UNITED STATES DEPARTMENT OF THE INTERIOR

I 28.37/a 2:

UNITED STATES DEPARTMENT OF THE INTERIOR • Donald Paul Hodel, Secretary

BUREAU OF MINES • Robert C. Horton, Director

This publication is a chapter from the current Bureau of Mines Minerals Yearbook, comprising *Volume I, Metals and Minerals; Volume II, Area Reports: Domestic; Volume III, Area Reports: International.* The separate volumes of the Yearbook are sold by the Superintendent of Documents, Washington, D.C. 20402.

The Mineral Industry of Brazil

By H. Robert Ensminger[1]

Brazil was the world leader in the production of beryllium and columbium. It was third in the production of bauxite, iron ore, manganese, sheet mica, and tantalum. In addition, it was in the top 10 in chromium, diatomite, feldspar, lime, lithium, magnesium compounds, rare earths, silicon, tin, and tungsten.

The extractive mineral industry expanded its output by 27.3% over that of 1983. The resultant increase in the value of mineral production contributed 4.65% to the gross domestic product (GDP). The Departamento Nacional da Produção Mineral (DNPM) estimated the total value of mineral production at approximately $9.2 billion,[2] up 21% over the figure for 1983.

The economy showed a marked improvement after 5 years of recession. Exports rose, imports fell, and the trade surplus doubled over that of 1983. Industrial production rose 5.9% over that of 1983 while the GDP rose 4.5% after a 3.2% drop in 1983. The inflation rate for 1984 was 224%, only slightly under the 230% registered in 1983. Brazil's important state enterprises presented a mixed picture by yearend. Publicly owned holding companies such as Petróleo Brasileiro S.A. (PETROBRÁS), Cia. Vale do Rio Doce (CVRD), and Telefonico Brasileiro S.A. (TELEBRÁS) have been generally self-financing, receiving few subsidies from the central Government. However, state enterprises such as Siderúrgia Brasileira S.A. (SIDERBRÁS), Electrico Brasileiro S.A. (ELECTROBRÁS), and Nuclear Brasileiro S.A. (NUCLEABRÁS) have borrowed heavily, and were deeply in debt; therefore, they received large subsidies.

Foreign investment in the Brazilian minerals and related sectors was $2.4 billion as of March 1984, with the metallurgical sector accounting for $1.3 billion. The United States was the leading investor in the minerals sector, and as of March 31, 1984, had accounted for $761 million (31.1%) of the total investment in the sector. Japan was second with $430 million.

Government Policies and Programs.—DNPM announced that since 1975 investment in basic mineral research declined 385%. There was also a decline of 33% in the number of research studies prepared and a decrease of 83% in the number of approved mining concessions granted during that period. DNPM reported that by yearend 1984, 40% of the country had been mapped at a scale of 1:250,000, 12% at a scale of 1:100,000, and 12% at a scale of 1:50,000.

Cia. de Pesquisa de Recursos Minerais (CPRM), the state mineral resources research company, invested approximately $1.2 million in mineral research. Of the total invested, approximately $600,000 was invested in copper, lead, and zinc projects at Palmeiropolis, Goiás, and Serra da Samambaia, São Paulo. CPRM also invested in the following: eight diamond projects, $221,000; seven tin ventures, $150,000; a titanium and chromium project, $27,500; and a phosphate and limestone venture, $13,300.

CPRM greatly expanded its overseas business to approximately $21.6 million, almost double the earnings for the period 1980-83. The most prominent projects were a joint venture with Libya, which resulted in a uranium discovery in that country, and the preparation of a study for the Latin American Energy Organization. In addition,

CPRM signed 98 contracts for drilling services, mineral technology, geologic mapping, geophysics, cartography, and consultants.

The Carajás Railroad and the preliminary stages of the iron ore and manganese mining projects were completed by yearend. Their inauguration is scheduled to take place early in 1985. The cost at this stage of the projects' development was $3.5 billion, compared with $5.07 billion forecast in 1981.

PRODUCTION

The DNPM estimated the value of mineral production at approximately $9.2 billion, which was an increase of $1.95 billion (21%) over that of 1983. The top 10 mineral commodities accounted for 86.3% of the value of the total production, with petroleum and natural gas comprising $5.4 billion of the total. The total production breakdown by category of the top 10 mineral commodities was as follows: fossil fuels, 70.6%; metallics, 25.3%; and nonmetallics, 4.1%. Iron ore replaced gold as the most valuable mineral in Brazil, excluding petroleum. Estimates for 1984 revealed that the value of Brazilian mineral production increased 221% in current prices and 34% in constant prices (base year 1977) over the 1983 level.

CVRD announced a new iron ore production schedule for the Grande Carajás project. The 25-million-ton-per-year production level should be attained in July 1986, instead of January 1987. By July 1987, CVRD projected production to reach 35 million tons, 6 months ahead of the original production schedule.

Table 1.—Brazil: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity[2]	1980	1981	1982	1983[p]	1984[e]
METALS					
Aluminum:					
Bauxite, dry basis, gross weight	5,537,676	5,770,448	6,289,713	7,198,671	5,239,000
Alumina	r516,967	496 639	606,177	786,648	800,000
Metal:					
Primary	r290,730	256,418	299,054	400,744	412,000
Secondary	r50,100	r36,040	46,280	e43,016	45,000
Antimony, mine output, metal content	46	269	--	--	--
Beryllium: Beryl concentrate, gross weight	550	853	1,062	e1,250	31,252
Cadmium, metal, primary	40	45	73	189	225
Chromium:					
Crude ore	833,935	926,413	668,000	468,737	500,000
Concentrate	187,396	152,859	158,500	110,978	120,000
Marketable product[4]	313,067	236,390	275,500	e276,000	280,000
Columbium-tantalum ores and concentrates, gross weight:					
Columbite and tantalite	538	299	201	264	275
Djalmaite concentrate	18	13	4	e7	10
Pyrochlore concentrate	30,700	29,886	19,593	16,828	24,839
Copper:					
Mine output, metal content	r402	r11,777	24,482	40,000	58,500
Metal, secondary	63,000	45,000	57,000	39,920	39,000
Gold:[e 5]					
Mine output ---- troy ounces	131,500	150,000	260,421	NA	NA
Garimpeiros (prospectors) ---- do.	1,168,500	1,050,000	1,186,361	NA	NA
Total ---- do.	1,300,000	1,200,000	1,446,782	r1,750,000	31,768,305
Iron and steel:					
Ore and concentrate, (marketable product):[4]					
Gross weight ---- thousand tons	114,732	r99,500	93,900	89,200	90,000
Iron content ---- do.	74,576	r64,675	61,035	57,980	58,500
Metal:					
Pig iron[6] ---- do.	r12,685	r10,796	10,827	12,945	17,200
Ferroalloys, electric-furnace:					
Chromium metal	--	6	6	7	3123
Ferroboron	27	--	--	--	311
Ferrocalcium silicon	8,025	7,481	9,657	7,400	317,755
Ferrochromium	93,443	118,780	96,646	77,326	3125,125
Ferrochromium-silicon	8,086	8,655	2,598	5,526	37,628
Ferrocolumbium	17,530	14,632	11,506	9,665	316,522
Ferromanganese	140,496	107,872	120,743	103,271	3106,459

See footnotes at end of table.

Table 1.—Brazil: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1980	1981	1982	1983[p]	1984[e]
METALS —Continued					
Iron and steel —Continued					
Metal —Continued					
Ferroalloys, electric-furnace —Continued					
Ferromolybdenum	802	797	337	126	[3]437
Ferronickel	11,280	10,744	10,597	25,991	30,000
Ferrophosphorus	354	346	22	1,211	[3]926
Ferrosilicon	109,146	120,662	115,314	156,683	[3]157,873
Ferrosilicon magnesium	13,734	11,002	11,275	10,698	[3]15,429
Ferrosilicon zirconium	488	497	503	85	[3]244
Ferrotitanium	698	498	430	166	[3]551
Ferrotungsten	217	95	74	228	[3]239
Ferrovanadium	807	296	238	102	[3]456
Inoculant		1,428	1,393	[e]1,400	1,500
Silicomanganese	134,243	142,743	172,358	[e]167,333	175,000
Silicon metal	13,302	18,957	17,921	20,602	[3]26,783
Total	552,672	565,491	571,618	587,820	683,061
Steel, crude, excluding castings thousand tons	15,339	13,230	12,999	14,660	[3]16,021
Semimanufactures, flat and nonflat do.	13,307	11,345	11,642	12,486	[3]18,385
Lead:					
Mine output, metal content	[r]21,754	[r]21,650	19,360	18,821	19,000
Metal:					
Primary	44,519	34,567	21,943	20,581	[3]25,982
Secondary	40,431	[r]31,029	27,407	28,939	30,000
Manganese ore and concentrate, marketable, gross weight[4]	2,281,450	2,042,144	2,340,979	2,091,631	1,900,000
Nickel:					
Mine output, metal content	4,291	6,811	13,093	10,741	13,200
Ferronickel, Ni content	2,504	2,340	4,813	10,741	12,720
Rare-earth metals: Monazite concentrate, gross weight	2,532	[r]2,460	1,814	15,256	5,000
Silver[7] thousand troy ounces	[r]784	765	760	743	[3]804
Tin:					
Mine output, metal content	[r]6,377	[r]8,253	9,293	13,418	17,700
Metal, smelter, primary	8,792	7,639	9,298	12,741	18,100
Titanium concentrates, gross weight:					
Ilmenite	16,839	[r]19,889	13,181	48,193	55,000
Rutile	428	[r]205	225	1,058	1,200
Tungsten, mine output, metal content	[r]1,116	[r]1,576	1,574	1,056	[3]998
Zinc:					
Concentrate and salable ore	392,148	400,631	596,971	662,126	675,000
Mine output, metal content	67,000	71,000	71,000	73,000	72,000
Metal, smelter:					
Primary	78,303	91,944	95,528	99,913	[3]106,927
Secondary	17,666	19,000	14,400	11,045	12,000
Zirconium: Zircon concentrate, gross weight[8]	3,410	6,000	4,966	13,790	13,000
NONMETALS					
Asbestos:					
Crude ore	2,602,501	1,992,766	2,092,087	2,090,472	2,000,000
Fiber	170,403	138,417	145,998	158,855	131,000
Barite:					
Crude	108,015	178,895	98,931	69,341	75,000
Beneficiated	62,085	98,804	122,219	100,106	125,000
Marketable product[4]	104,752	116,340	120,000	118,000	150,000
Calcite	41,842	30,912	72,507	48,993	50,000
Cement, hydraulic thousand tons	27,193	26,051	25,644	20,870	25,000
Clays:					
Bentonite	247,954	166,338	164,060	128,691	135,000
Kaolin:					
Crude	1,156,447	1,063,480	1,243,520	1,241,252	1,250,000
Beneficiated	410,197	469,757	493,186	420,120	450,000
Marketable product[4]	477,858	556,753	550,000	[e]490,000	500,000
Other:					
Crude thousand tons	5,582	21,601	22,160	21,784	22,000
Beneficiated do.	1,656	2,229	1,442	1,034	1,100
Diamond:[9]					
Gem thousand carats	253	163	80	100	220
Industrial do.	414	926	450	450	330
Total[3] do.	667	1,089	530	550	550
Diatomite:					
Crude	12,000	13,202	106,581	22,431	22,000
Beneficiated	10,807	8,858	13,131	8,663	8,500
Marketable product[4]	14,828	8,973	13,146	[e]16,000	NA

See footnotes at end of table.

Table 1.—Brazil: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]	1980	1981	1982	1983[p]	1984[e]
NONMETALS —Continued					
Feldspar and related materials:					
Feldspar, marketable product[4]	123,263	118,407	131,853	e150,000	NA
Leucite, marketable product[4]	6,796	536	209	3,588	NA
Sodalite, crude, marketable product	561,875	859,125	e400	e500,000	NA
Total	691,934	978,068	132,462	r,e653,588	NA
Fluorspar:					
Crude	86,347	174,665	201,971	239,522	240,000
Concentrates, marketable product:					
Acid-grade	32,729	36,226	32,000	43,000	45,000
Metallurgical-grade	22,640	17,403	19,000	26,000	27,000
Total	55,369	53,629	51,000	69,000	72,000
Graphite:					
Crude	234,883	464,089	359,991	442,810	445,000
Marketable product:					
Direct-shipping crude ore	6,000	16,318	6,131	NA	NA
Concentrate	21,294	17,499	15,413	16,498	18,000
Total	27,294	33,817	21,544	NA	NA
Gypsum and anhydrite, crude	r545,501	r597,461	680,800	555,907	556,000
Kyanite:					
Crude	18,296	r2,155	1,076	735	700
Marketable products[4]	r4,056	1,590	423	429	500
Lime, hydrated and quicklime[5] thousand tons	4,810	5,000	5,000	5,000	NA
Lithium mineral concentrates:					
Amblygonite	182	277	66	113	120
Lepidolite	51	2	74	1	5
Petalite	2,487	2,080	2,293	1,892	2,000
Spodumene	98	243	341	116	120
Total	2,818	2,602	2,774	2,122	2,245
Magnesite:					
Crude	788,365	618,251	505,385	486,374	500,000
Beneficiated	315,851	285,792	225,533	231,000	235,000
Mica, all grades[16]	4,817	r787	878	3,595	3,500
Nitrogen: N content of ammonia	351,600	375,700	503,200	738,100	750,000
Phosphate rock including apatite:					
Crude:					
Mine product thousand tons	16,533	16,441	25,070	19,898	23,900
Of which, sold directly do.	50	53	7,395	NA	NA
Concentrate:					
Gross weight do.	r2,562	r2,658	2,767	3,208	3,855
P_2O_5 content do.	r1,489	r1,083	887	1,069	1,345
Pigments, mineral: Other, crude	6,465	4,153	5,272	e6,000	6,000
Precious and semiprecious stones except diamond, crude and worked:[10]					
Agate kilograms	1,738,890	1,424,381	1,038,287	966,095	NA
Amethyst do.	310,594	234,198	195,502	244,269	NA
Aquamarine do.	6,739	3,807	24,479	4,727	NA
Cat's-eye do.	--	30	NA	2	NA
Citrine do.	62,971	52,094	29,760	30,572	NA
Emerald do.	9,126	10,538	7,646	9,640	NA
Garnet do.	54	2	16	241	NA
Opal do.	2,169	103	46	48	NA
Ruby value	--	--	NA	$17,868	NA
Sapphire do.	--	--	NA	$9,814	NA
Topaz kilograms	7,189	4,011	3,631	3,822	NA
Tourmaline do.	3,938	4,319	2,669	12,498	NA
Turquoise value	NA	NA	--	$1,051	NA
Other kilograms	292,677	249,660	188,674	620,796	NA
Quartz crystal, all grades[10]	5,753	5,154	7,421	9,681	10,000
Salt:					
Marine thousand tons	3,042	2,766	2,888	3,259	3,300
Rock do.	796	839	836	928	950
Silica (silex)	10,245	4,517	7,978	2,200	2,500
Sodium compounds:					
Caustic soda	691,000	759,000	760,000	728,000	750,000
Soda ash, manufactured (barilla)	176,000	188,000	199,000	210,000	190,000
Stone, sand and gravel:					
Dimension stone:					
Marble, rough-cut cubic meters	r67,844	r66,839	122,114	141,380	NA
Slate	7,679	19,464	4,411	98,009	NA
Crushed and broken stone:					
Basalt cubic meters	483,617	438,391	329,564	153,733	NA

See footnotes at end of table.

Table 1.—Brazil: Production of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity[2]		1980	1981	1982	1983[p]	1984[e]
NONMETALS —Continued						
Stone, sand and gravel —Continued						
Crushed and broken stone —Continued						
Calcareous shells		1,244,464	1,212,252	1,328,960	1,214,171	NA
Dolomite	thousand tons	1,354	1,961	1,954	1,714	NA
Gneiss	cubic meters	434,001	218,025	249,798	190,563	NA
Granite	thousand cubic meters	47,032	49,225	43,720	35,261	NA
Limestone	thousand tons	50,170	52,066	49,027	44,918	50,625
Quartz[11]		133,068	144,707	67,527	83,590	NA
Quartzite:						
Crude		245,592	795,104	636,797	250,352	NA
Processed		139,282	122,700	102,826	93,246	NA
Sand	thousand cubic meters	22,014	35,876	40,088	24,450	NA
Sulfur:						
Frasch	thousand tons	--	--	--	1	1
Pyrites	do.	25	44	54	55	55
Byproduct:						
Metallurgy	do.	--	17	30	150	150
Petroleum	do.	131	102	100	110	110
Total	do.	156	163	184	316	316
Talc and related materials:						
Talc, marketable product[4]		338,450	325,191	328,644	NA	NA
Pyrophyllite, marketable product[4]		74,606	178,464	76,624	NA	NA
Other: Agalmatolite, marketable product		131,034	49,147	63,068	NA	NA
Vermiculite:						
Crude		35,466	77,997	43,316	42,337	45,000
Marketable product[4]		12,181	14,307	14,059	[e]15,000	15,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous, marketable[4]	thousand tons	8,300	5,300	6,200	6,270	[3]7,153
Coke, metallurgical, all types	do.	4,049	5,700	NA	NA	NA
Gas, natural:						
Gross	million cubic feet	77,868	88,286	106,968	141,700	[3]173,119
Marketed	do.	[e]50,000	NA	NA	NA	NA
Natural gas liquids	thousand 42-gallon barrels	2,063	2,426	2,950	[e]3,700	4,000
Petroleum:						
Crude	do.	68,496	77,895	94,738	123,700	[3]169,031
Refinery products:						
Gasoline	do.	68,301	71,100	74,589	64,300	69,999
Jet fuel	do.	20,278	23,360	19,975	17,600	18,000
Kerosine	do.	4,095	NA	4,024	4,500	5,000
Distillate fuel oil	do.	121,846	216,502	122,105	113,900	126,784
Residual fuel oil	do.	105,392	NA	89,397	80,300	90,000
Lubricants	do.	4,233	3,755	4,801	4,800	5,500
Other	do.	69,692	NA	NA	NA	NA
Refinery fuel and losses	do.	11,252	NA	NA	NA	NA
Total	do.	405,089	NA	NA	NA	NA

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.

[1]Table includes data available through Sept. 7, 1984.

[2]In addition to the commodities listed, bismuth, molybdenite, and uranium oxide are produced, but output is not reported, and available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

[4]Direct sales and beneficiated.

[5]Officially reported figures are as follows, in troy ounces: major mines: 1980—131,432; 1981—140,691; 1982—148,408; 1983—199,206; and 1984—not available. Small mines (garimpos): 1980—310,704; 1981—414,744; 1982—671,982; 1983—1,526,775; and 1984—not available.

[6]Includes sponge iron as follows, in thousand metric tons: 1980—275; 1981—226; 1982—226 (estimated); 1983—255 (estimated); and 1984—246 (estimated).

[7]Partially revised officially reported output; of total production, the following quantities are identified as placer silver (the balance being silver content of other ores and concentrates), in thousand troy ounces: 1980—47; 1981—144; 1982—123; 1983—247; and 1984—not available.

[8]Includes baddeleyite-caldasite.

[9]Figures represent officially reported output plus official Brazilian estimates of output by nonreporting miners; officially reported output was as follows, in thousand carats: 1980—158; 1981—136; 1982—not available; 1983—not available; and 1984—not available.

[10]Exports.

[11]Apparently includes crude quartz used to produce quartz crystal (listed separately in this table) as well as additional quantities of common quartz.

TRADE

Brazil recorded a record high overall trade surplus of approximately $13.1 billion, which was double the surplus of 1983. Much of the increased surplus was due to the increase in domestic petroleum production, which satisfied 60% of the domestic demand. The metallic mineral exports totaled $1.63 billion, which comprised approximately 6% of the total export value. Of the metallic mineral export total, iron ore comprised 65% based on 87.2 million tons exported.

Coal accounted for approximately 91% of mineral sales by the United States to Brazil. In 1983, the United States exported 92 commodities to Brazil, while the number decreased to 43 in 1984. In 1983, the United States supplied Brazil with 79% of its mining equipment imports. In 1984, the U.S. share decreased to 57%.

Brazil was the principal source to the United States for columbium and industrial quartz crystal. In addition, Brazil also supplied the United States with beryllium, silicon, and tantalum.

CPRM plans to expand markets in Latin America, northern Africa, southern Africa, and the Middle East in 1985. The company is forming joint ventures in Algeria, Colombia, Iraq, Libya, Mexico, Morocco, Mozambique, Nicaragua, Paraguay, Peru, Tanzania, and Uruguay.

Table 2.—Brazil: Exports and reexports of selected mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1982	1983	Destinations, 1983	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate thousand tons	2,991	3,989	853	Canada 1,554; Venezuela 1,121.
Oxides and hydroxides	4,939	7,102	--	Argentina 6,631; Paraguay 377.
Metal including alloys:				
Unwrought	3,676	116,325	14,506	Japan 88,026; Taiwan 9,511.
Semimanufactures	8,451	38,324	7,846	Japan 8,335; Saudi Arabia 5,495.
Antimony: Oxides	4	56	--	All to West Germany.
Beryllium: Ore and concentrate	1,063	943	943	
Chromium:				
Ore and concentrate	240	--	--	
Oxides and hydroxides kilograms	50	100	--	All to Paraguay.
Metal including alloys, all forms	3	10	--	Mainly to Argentina.
Cobalt: Metal including alloys, all forms	7	34	17	Netherlands 17.
Columbium and tantalum: Ore and concentrate	167	129	76	Netherlands 48.
Copper:				
Matte and speiss including cement copper	700	246	--	All to Belgium-Luxembourg.
Metal including alloys:				
Unwrought	9	21	18	Argentina 3.
Semimanufactures	10,016	16,042	13,334	Canada 512; Colombia 403.
Gold: Metal including alloys, unwrought and partly wrought troy ounces	--	6	6	
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite thousand tons	80,927	74,200	1,568	Japan 25,823; West Germany 12,680; Romania 3,910.
Metal:				
Pig iron, cast iron, related materials	r679,265	1,803,332	185,066	China 395,724; Japan 266,481.
Ferroalloys:				
Ferrochromium	51,770	38,048	9,900	Japan 27,200; Argentina 717.
Ferrocolumbium	11,036	9,256	1,964	Netherlands 1,880; Japan 1,742.
Ferromanganese	26,435	49,511	37,000	Japan 5,000; Turkey 3,000.
Ferromolybdenum	33	1	--	All to Bolivia.
Ferronickel	1,529	15,494	2,662	West Germany 7,546; Sweden 3,688.
Ferrosilicomanganese	59,301	123,708	47,049	Japan 62,376; China 6,850.
Ferrosilicon	64,518	111,846	37,205	Japan 68,268; China 1,690.
Ferrotungsten	60	222	--	Japan 140; Netherlands 70; Argentina 12.
Silicon	11,827	14,486	5,362	Japan 8,207; West Germany 101.
Unspecified	r7,784	7,538	5,459	Japan 450; Netherlands 447.
Steel, primary forms	224,131	465,467	31,331	Nigeria 52,315; Taiwan 41,245; Saudi Arabia 40,000.

See footnotes at end of table.

Table 2.—Brazil: Exports and reexports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1982	1983	Destinations, 1983	
			United States	Other (principal)
METALS —Continued				
Iron and steel —Continued				
Metal —Continued				
Semimanufactures:				
Bars, rods, angles, shapes, sections	627,422	1,430,204	170,397	Saudi Arabia 194,056; China 158,659.
Universals, plates, sheets	1,301,758	2,955,593	907,173	Iran 500,608; Japan 367,527; China 310,144.
Hoop and strip	14,128	22,001	2,143	West Germany 11,919; Singapore 1,501.
Rails and accessories	1,884	240	--	Paraguay 141; Netherlands 82.
Wire	18,755	35,166	15,012	Nigeria 5,998; Panama 2,463.
Tubes, pipes, fittings	172,383	229,479	170,091	Colombia 8,375; Venezuela 5,584.
Castings and forgings, rough	1,772	4,614	1,649	Belgium-Luxembourg 1,777; Bahamas 500.
Lead:				
Oxides kilograms	--	105	--	All to Bolivia.
Metal including alloys, all forms	6	31	1	Paraguay 24; Ecuador 3.
Lithium:				
Ore and concentrate	2,347	17	--	All to Italy.
Oxides and hydroxides kilograms	2,018	5	--	All to Argentina.
Magnesium: Metal including alloys, semimanufactures do	--	152	--	All to Paraguay.
Manganese:				
Ore and concentrate, metallurgical-grade	990,052	747,436	79,863	United Kingdom 116,400; Czechoslovakia 108,175.
Oxides	3,045	1,884	--	Argentina 966; Colombia 400; Mexico 247.
Metal including alloys, all forms kilograms	498	10	--	All to Iraq.
Molybdenum: Metal including alloys, all forms do	46	152	--	Turkey 81; Chile 71.
Nickel: Metal including alloys:				
Unwrought	52	45	(2)	Argentina 32; United Kingdom 13.
Semimanufactures	42	36	4	Argentina 29; Colombia 2.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, platinum troy ounces	38,774	6	--	All to Argentina.
Silver: Metal including alloys, unwrought and partly wrought do	29,579	51,763	3,344	West Germany 48,323.
Tin: Metal including alloys:				
Unwrought	4,346	8,820	5,887	Italy 1,310; Hungary 619.
Semimanufactures	63	1	(2)	Mainly to Uruguay.
Titanium:				
Oxides kilograms	4,500	350	--	Paraguay 300; Uruguay 50.
Metal including alloys, semimanufactures do	160	--		
Tungsten:				
Ore and concentrate	1,860	1,482	237	West Germany 765; Netherlands 250.
Metal including alloys, all forms	1	1	--	Mainly to Mexico.
Zinc:				
Oxides	(2)	27	--	Mainly to Chile.
Metal including alloys:				
Unwrought	2,500	20	--	All to Bolivia.
Semimanufactures	18	25	--	Paraguay 24.
Other:				
Ashes and residues	436	1,979	183	Japan 946; United Kingdom 322; Norway 190.
Base metals including alloys, all forms	r8	15	9	Netherlands 6.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc kilograms	1,334	2,038	100	Bolivia 1,509; Paraguay 400.
Artificial:				
Corundum	10,343	18,576	4,498	Argentina 4,609; Japan 3,458.
Silicon carbide	691	5,575	951	Japan 3,799; Singapore 158.
Grinding and polishing wheels and stones	1,402	877	359	Chile 101; Hong Kong 86.
Asbestos, crude	7,022	11,750	--	Argentina 4,205; Mexico 2,836; India 2,690.
Barite and witherite	19,730	6,300	--	All to Venezuela.
Cement	10,524	19,553	--	Paraguay 15,824; Bolivia 1,839.
Chalk	--	10	--	All to Venezuela.
Clays:				
Bentonite	180	1,890	--	Oman 1,875; Paraguay 15.
Kaolin	175,121	181,555	--	Belgium-Luxembourg 94,011; Japan 38,817; Italy 31,006.
Unspecified	901	573	--	Uruguay 350; Argentina 190.

See footnotes at end of table.

Table 2.—Brazil: Exports and reexports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1982	1983	Destinations, 1983	
			United States	Other (principal)
NONMETALS —Continued				
Diamond:				
Gem, not set or strung ..... carats	18,160	23,305	1,490	West Germany 21,530.
Industrial stones ..... do	200	--		
Dust and powder ..... do	200	--		
Feldspar	5	4,000	--	All to Italy.
Fertilizer materials: Manufactured:				
Ammonia	136	125,191	--	Mozambique 27,000; Italy 23,000; France 18,000.
Nitrogenous	2,010	142,414	31,864	China 50,000; Taiwan 25,000.
Phosphatic	6,766	7,624	--	Argentina 4,220; Paraguay 2,104; Uruguay 1,300.
Potassic	195	953	--	Argentina 521; Uruguay 397; Paraguay 35.
Unspecified and mixed	23,827	115 214	11,400	Italy 57,500; Argentina 26,394.
Graphite, natural	5,396	5,578	3,437	Japan 735; Republic of South Africa 578.
Gypsum and plaster	112	54	--	Paraguay 50; Mozambique 3.
Lime	5,624	3,665	--	Paraguay 3,621; Bolivia 44.
Magnesium compounds:				
Magnesite	--	4	--	Argentina 2; Uruguay 2.
Oxides and hydroxides	95,808	73,735	6,000	Poland 45,691; Argentina 12,023.
Other	--	67	--	Argentina 49; Paraguay 15.
Meerschaum, amber, jet	457	--		
Mica: Crude including splittings and waste	1,078	3,407	408	United Kingdom 1,402; West Germany 798.
Pigments, mineral:				
Natural, crude	--	12	--	All to Bolivia.
Iron oxides and hydroxides, processed	404	352	102	Paraguay 79; Chile 56.
Precious and semiprecious stones other than diamond:				
Natural ..... value, thousands	$38,420	$23,905	$8,879	Japan $5,156; West Germany $4,060.
Synthetic ..... do	$3	$23		All to Japan.
Salt and brine	186,180	243,224	144,800	Uruguay 73,499; Paraguay 15,454.
Sodium compounds, n.e.s.:				
Carbonate, manufactured	r22	7	--	Bolivia 4; Paraguay 2.
Sulfate, manufactured	42	2	--	All to Paraguay.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	75,917	101,556	133	Italy 72,876; Japan 15,484.
Worked	9,058	7,671	4,482	Japan 1,663; Paraguay 531.
Dolomite, chiefly refractory-grade	250	646	--	Argentina 610; Uruguay 36.
Gravel and crushed rock	13,525	2,634	--	Bolivia 2,557; Argentina 55.
Limestone other than dimension	1,060	1,026	--	All to Paraguay.
Quartz and quartzite	7,579	10,226	109	West Germany 5,903; Belgium-Luxembourg 2,069.
Sand other than metal-bearing	4,275	5,675	--	Argentina 2,227; Colombia 1,931; Bolivia 763.
Sulfur:				
Elemental, all forms	20	34	--	Mainly to Uruguay.
Sulfuric acid	161	292	--	Argentina 200; Bolivia 81.
Talc, steatite, soapstone, pyrophyllite	99	1,295	75	Venezuela 951; Paraguay 91.
Vermiculite	1,502	999	981	Australia 18.
Other:				
Crude	r153	199	--	Liberia 89; Argentina 68; Bolivia 35.
Slag and dross, not metal-bearing	101	200	--	All to Argentina.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	600	--		
Carbon: Carbon black	617	469	--	Costa Rica 212; Angola 90; Chile 84.
Coal: Anthracite	560	717	--	Argentina 625; Paraguay 92.
Coke and semicoke	--	28	--	All to Paraguay .
Petroleum:				
Crude ..... thousand 42-gallon barrels	7,955	370	370	
Refinery products:				
Liquefied petroleum gas ..... do	356	493	--	Paraguay 224; Suriname 124; Japan 104.
Gasoline ..... do	9,612	18,956	14,979	Zaire 787; Mozambique 581.
Mineral jelly and wax ..... do	199	284	103	Mexico 69; Colombia 24.
Kerosine and jet fuel ..... do	4,786	4,296	377	Zaire 1,356; Italy 803.
Distillate fuel oil ..... do	7,635	5,022	--	Zaire 2,070; Mozambique 1,085.
Lubricants ..... do	682	1,068	56	Mexico 599; Zaire 138.
Nonlubricating oils ..... do	79	69	--	Mexico 35; Taiwan 24; Japan 9.
Residual fuel oil ..... do	9,573	20,109	19,103	United Kingdom 579.

rRevised.

[1]Table prepared by W. L. Zajac.

[2]Less than 1/2 unit.

Table 3.—Brazil: Imports of selected mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1982	1983	Sources, 1983	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	8,598	5,020	2,500	Guyana 2,500.
Oxides and hydroxides	86,995	202,824	55,280	Netherlands 66,292; Jamaica 44,611.
Metal including alloys:				
Scrap	3,750	4,128	187	Italy 3,941.
Unwrought	10,766	2,958	48	Argentina 935; Norway 698; Italy 432.
Semimanufactures	2,783	1,330	580	West Germany 249; Japan 192.
Beryllium: Metal including alloys, all forms, value, thousands	$3	$1	--	All from West Germany.
Chromium:				
Ore and concentrate	4,381	5,897	4,210	Republic of South Africa 1,683.
Oxides and hydroxides	40	50	(2)	United Kingdom 18; Poland 16.
Cobalt: Oxides and hydroxides	21	21	13	West Germany 4.
Columbium and tantalum: Metal including alloys, all forms, tantalum, value, thousands	$100	$83	$74	West Germany $6.
Copper:				
Ore and concentrate	10,544	89,159	--	All from Chile.
Metal including alloys:				
Scrap	1,437	441	--	Mainly from Chile.
Unwrought	204,748	56,442	47	Chile 37,649; Peru 7,971; Bahamas 3,835.
Semimanufactures	1,803	1,957	1,023	West Germany 246; United Kingdom 242.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	12	14	8	Switzerland 5.
Metal:				
Scrap	7,186	--		
Pig iron, cast iron, related materials	r58,885	4,840	2,182	West Germany 972; Canada 833.
Ferroalloys	1,228	520	31	Belgium-Luxembourg 188; Republic of South Africa 181.
Steel, primary forms	214,019	6,813	3	West Germany 6,284; France 268; Japan 216.
Semimanufactures:				
Bars, rods, angles, shapes, sections	26,049	15,175	590	United Kingdom 7,929; West Germany 3,437.
Universals, plates, sheets	122,451	30,775	681	France 11,772; Japan 8,421.
Hoop and strip	4,339	4,430	1,114	West Germany 2,228; United Kingdom 375.
Rails and accessories	27,488	19,688	816	Japan 13,493; Belgium-Luxembourg 5,010.
Wire	1,679	1,509	87	Italy 952; Japan 277.
Tubes, pipes, fittings	24,172	5,487	717	France 1,476; West Germany 1,420.
Castings and forgings, rough	225	79	2	West Germany 64; Italy 10.
Lead:				
Ore and concentrate	--	6,591	1,295	Ireland 3,007; Peru 2,288.
Oxides	335	488	5	Mexico 283; Peru 200.
Metal including alloys:				
Scrap	--	2,849	2,849	
Unwrought	669	649	--	All from Mexico.
Magnesium: Metal including alloys:				
Scrap	582	183	--	Netherlands 71; Republic of South Africa 71.
Unwrought	5,583	6,191	4,005	Norway 2,186.
Manganese:				
Ore and concentrate, metallurgical-grade	11,324	19,206	7,800	Gabon 6,000; Mexico 3,913.
Oxides	13	54	52	Belgium-Luxembourg 1.
Mercury, 76-pound flasks	3,655	2,669	116	Mexico 2,494; China 58.
Molybdenum: Metal including alloys, all forms	42	41	14	Netherlands 12; West Germany 9.
Nickel:				
Matte and speiss, value, thousands	$145	$28	$18	West Germany $10.
Metal including alloys:				
Scrap	50	--		
Unwrought	1,735	174	104	Norway 44; Canada 13.
Semimanufactures	556	177	43	West Germany 81; France 20.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, value, thousands	$2,014	$2,566	$184	West Germany $1,880; Japan $267.
Silver: Metal including alloys, unwrought and partly wrought, do.	$23,013	$38,433	$903	Peru $29,660; Mexico $7,505.
Tin: Metal including alloys, semimanufactures	15	9	(2)	Netherlands 5; West Germany 4.
Titanium: Oxides	1,843	1,475	45	West Germany 597; France 471.

See footnotes at end of table.

Table 3.—Brazil: Imports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1982	1983	Sources, 1983	
			United States	Other (principal)
METALS —Continued				
Tungsten:				
Ore and concentrate	1,303	1,465	47	Chile 1,423.
Metal including alloys, all forms	36	80	12	Netherlands 40; West Germany 15.
Zinc:				
Ore and concentrate	55,672	58,695	8,173	Peru 45,068; Canada 2,754.
Oxides	494	288	8	Netherlands 174; West Germany 77.
Blue powder	3	17	15	West Germany 2.
Metal including alloys:				
Unwrought	7,403	3,599	1	Mexico 3,180; Zaire 189.
Semimanufactures	91	14	--	Belgium-Luxembourg 12.
Other:				
Ores and concentrates	r68,579	30,009	2,085	Australia 22,399; Thailand 486.
Ashes and residues	1,236	3,692	3,692	
Base metals including alloys, all forms	2,130	2,742	454	Republic of South Africa 879; West Germany 301.
NONMETALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	198	707	142	Italy 503; West Germany 41.
Artificial: Corundum	248	151	11	France 56; Japan 44.
Dust and powder of precious and semiprecious stones including diamond value, thousands	$2,744	$3,883	$3,000	Ireland $621; West Germany $219.
Grinding and polishing wheels and stones	198	114	49	West Germany 44; United Kingdom 5.
Asbestos, crude	13,193	7,772	67	Canada 6,015; Italy 1,186.
Barite and witherite	60	44	--	West Germany 30; Switzerland 14.
Boron materials:				
Crude natural borates	7,332	5,964	--	Peru 3,554; Argentina 2,410.
Oxides and acids	4,082	2,993	360	Argentina 2,281; France 155.
Cement	21,274	2,399	1,237	France 680; Argentina 300.
Chalk	94	49	--	All from France.
Clays, crude	11,914	12,934	7,585	Argentina 4,794; France 406.
Cryolite and chiolite	31	21	--	Denmark 20; West Germany 1.
Diamond:				
Gem, not set or strung value, thousands	$1,598	$691	--	Israel $368; Belgium-Luxembourg $170.
Industrial stones do	$808	$509	$433	West Germany $40; Ireland $36.
Diatomite and other infusorial earth	1,829	2,217	1,132	Mexico 765; West Germany 263.
Feldspar, fluorspar, related materials	--	5	--	All from West Germany.
Fertilizer materials: Manufactured:				
Ammonia	57,007	16,000	(2)	Mainly from U.S.S.R.
Nitrogenous	881,420	429,342	272,131	Netherlands 85,725; West Germany 42,071.
Phosphatic	106,931	1,325	--	Uruguay 1,250; Netherlands 75.
Potassic	1,493,776	1,216,753	14,822	East Germany 685,710; Canada 309,296.
Unspecified and mixed	156,893	86,500	43	Chile 86,447.
Graphite, natural	42	2	(2)	West Germany 1.
Gypsum and plaster	801	1	1	
Lime	40	71	--	All from Belgium-Luxembourg.
Magnesite	1,447	697	502	West Germany 184.
Mica:				
Crude including splittings and waste	76	109	--	All from Canada.
Worked including agglomerated splittings	61	43	12	France 12; Belgium-Luxembourg 9.
Nitrates, crude	15,580	9,667	--	All from Chile.
Phosphates, crude	234,643	5	5	
Pigments, mineral: Iron oxides and hydroxides, processed	1,531	1,328	154	West Germany 1,130; Spain 42.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$309	$37	$28	Israel $5; Switzerland $4.
Synthetic do	$32	$19	--	Switzerland $16.
Pyrite, unroasted	90	31	31	
Sodium compounds, n.e.s.:				
Carbonate, manufactured	117,655	70,224	52,596	France 11,879; Belgium-Luxembourg 2,002.
Sulfate, manufactured	106,576	NA		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	7	--		
Worked	6	6	--	All from Portugal.

See footnotes at end of table.

Table 3.—Brazil: Imports of selected mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1982	1983	Sources, 1983	
			United States	Other (principal)
NONMETALS —Continued				
Stone, sand and gravel —Continued				
Dolomite, chiefly refractory-grade	2,280	1,419	--	Italy 1,418.
Gravel and crushed rock	209	--		
Quartz and quartzite	14	35	11	Switzerland 20.
Sand other than metal-bearing	510	490	40	Argentina 450.
Sulfur:				
Elemental:				
Crude including native and byproduct	882,540	953,789	108,106	Canada 492,688; Poland 313,446.
Colloidal, precipitated, sublimed	479	537	525	West Germany 8.
Sulfuric acid	97,256	54,134	3	Spain 36,157; Sweden 11,533.
Talc, steatite, soapstone, pyrophyllite	35	36	25	France 5; Norway 5.
Other:				
Crude	6,372	10,159	61	Argentina 8,662; Australia 1,211.
Slag and dross, not metal-bearing	14,092	27,414	--	Republic of South Africa 26,218; West Germany 1,192.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	405	139	95	Argentina 44.
Carbon: Carbon black	3,656	3,049	814	West Germany 1,156; Japan 374.
Coal: All grades excluding briquets thousand tons	4,361	6,295	3,295	Poland 1,800; Australia 432.
Coke and semicoke	126,044	220,531	(2)	Japan 105,000; West Germany 89,874; Poland 25,157.
Petroleum:				
Crude thousand 42-gallon barrels	290,888	267,243	--	Saudi Arabia 72,694; Iraq 65,820; Venezuela 23,246.
Refinery products:				
Liquefied petroleum gas do	7,726	5,873	254	Saudi Arabia 2,679; Angola 1,100; Algeria 833.
Gasoline do	783	965	105	Netherlands Antilles 592; Italy 158.
Distillate fuel oil do	1,795	1,706	(2)	Argentina 718; Mexico 438; Venezuela 297.
Lubricants do	298	159	28	Romania 111; Netherlands Antilles 17.
Nonlubricating oils do	82	81	(2)	Mainly from Romania.
Residual fuel oil do	10,859	4,128	282	Venezuela 1,073; Kuwait 1,010; Argentina 711.
Petroleum coke do	385	105	83	Japan 11; United Kingdom 11.

[r] Revised. NA Not available.
[1] Table prepared by W. L. Zajac.
[2] Less than 1/2 unit.

COMMODITY REVIEW

METALS

Alumina, Aluminum, and Bauxite.— Aluminum production reached 457,000 tons, approximately 3% greater than that of 1983. Brazil exported approximately 222,000 tons of aluminum, valued at $323.65 million. This was an increase in value of 18% over that of 1983.

In August 1984, the Alumínio do Maranhão S.A. complex was inaugurated at São Luis, Maranhão. The first stage of production is to reach 500,000 tons of alumina and 100,000 tons of aluminum per year in 1985. The second stage planned for 1986 will have an annual production level of 3 million tons of alumina and 245,000 tons of aluminum.

Reynolds Metals Co. (United States) proposed doubling of capacity of the Vale do Sul Alumínio S.A. (VALESUL) smelter to 180,000 tons per year at a cost of $180 million. Reynolds is a 4% shareholder in VALESUL with CVRD (51%) and Shell do Brasil S.A. (45%).

In January 1984, The Hanna Mining Co. Inc. of the United States agreed to sell its minority interest in Alcoa Alumínio do Brasil S.A. to joint owner Aluminum Co. of America (United States) for $55 million. Hanna received $35 million in payment in August with the remaining $20 million of the purchase price to be paid over a 4-year period.

Toward yearend, the consortium of Alumínio Brasileiro S.A. and Alumina do Norte do Brasil S.A. (ALUNORTE) was dissolved, with ALUNORTE concentrating solely on alumina production. When completed,

ALUNORTE will have a capacity of 800,000 tons per year and will have required an investment of about $700 million. Nippon Amazon Aluminum Co. (NALCO) by year-end was considering pulling out of the ALUNORTE project. ALUNORTE officials expected a final decision by the Japanese no later than September 1985. NALCO is comprised of 33 Japanese firms headed by the Export-Import Bank of Japan and has a 49% share in the project. ALUNORTE stated that the project ultimately will produce 800,000 tons per year, with or without Japanese participation.

A Brazilian group, Indústrias Quimicas Cataguazes and CVRD were analyzing a bauxite deposit at Cataguazes, Minas Gerais, at yearend. This deposit has indicated reserves of approximately 39 million tons of excellent-grade bauxite. In the same region, Cia. Brasileira de Alumínio and the Aluminum Co. of Canada have measured reserves of 45 million tons of the same grade bauxite. CVRD discovered a bauxite deposit with measured reserves of 50 million tons located at kilometer 350 on the Carajás-Itaqui Railroad. The deposit is an extension of the Paragomina, Pará, bauxite reserves.

Total Brazilian bauxite reserves at yearend were determined to be approximately 4.5 billion tons, of which 2.4 billion tons was in the Carajás region. This ranked Brazil third in the world after New Guinea and Australia for major bauxite reserves.

Cobalt.—Cia. Niquel Tocantins announced plans to begin cobalt production in 1985. Brazil is totally dependent on imported cobalt, and from January through August 1984, imported 170 tons valued at $2.7 million. In Brazil, cobalt is always found in association with manganese and nickel in the States of Goiás, where Tocantins has nickel reserves, and in Bahia, Minas Gerais, Amazonas, and Rondônia.

Columbium.—Cia. Brasileira de Metalurgia e Mineração (CBMM), the world's largest producer of ferrocolumbium and columbium oxide, produced 13,500 tons of contained columbium in ferrocolumbium and 680 tons of columbium in columbium oxide.

A major columbium ore deposit was discovered in the Amazonas region, about 100 kilometers from the Venezuelan border. The discovery, made in the township of São Gabriel do Cachoeira, is estimated to have added approximately 2.9 million tons to Brazil's existing 4.6 million tons of reserves of the metal. This figure constitutes about 95% of the Western World's reserves. CPRM is expected to invest about $1.12 million to develop the project, known as Uapes. The ore grades, on average, 2.81% pyrochlore.

CBMM completed a $200 million deal with the U.S.S.R. to export 200 tons per year of columbium oxide. The last Brazilian exports to the U.S.S.R. were made in 1981 with a shipment of 40 tons. Brazil's largest importer of columbium in 1984 was the United States with 1,000 tons.

Copper.—The failure of Brazil to reach its production target of 115,000 tons in 1984 meant that the shortfall had to be imported. Because of shutdowns, owing to problems at the smelter and at the sulfuric acid plant, production was reduced to about 97,500 tons. CVRD plans to start producing 16,000 tons annually of copper and zinc from reserves at Pojuco in the Carajás region in 1985.

In 1984, Brazil's third copper mine began production. The Pedra Verde Mine, at Viçosa do Ceará, 370 kilometers northeast of Fortaleza, Ceará, is operated by Guanordeste Mineração e Cómercio Ltda. The small mine should reach a production level of 80 tons per month of contained copper. An additional 16 copper deposits are known in Brazil with the deposits at Salobo, Mara Rosa, Caraíba, and Camaqua accounting for 90% of the total reserves. At yearend, the reserves were estimated at about 12.6 million tons of contained copper with the Salobo 3A deposit at Carajás comprising 73% of the total.

CVRD was negotiating the transfer of mining technology for the Salobo copper deposit, 60 kilometers northeast of the Carajás railhead, with the U.S.S.R. state company, Stuet-Pramet-Export.

Gold.—The 1984 gold production figures were very problematical. Much of the domestic production never found its way into the official gold market. Production from Serra Pelada diminished to a little over 64,302 troy ounces, because it was closed from November 1983 to September 1984. The two reasons for the closing were to implement earth-leveling safety procedures and the awaiting of new legislation, which would allow the garimpeiros (small miners) to continue for another 3 years at the site.

In June 1984, Mineração Morro Velho S.A. celebrated its 150th anniversary. The mining company, controlled by Bozanno Simonsen (51%) and Anglo American Corp. of South Africa Ltd. (49%), reported production of 183,259 troy ounces of gold.

CVRD commenced production at its Araci gold deposit in the State of Bahia. The

company is utilizing for the first time in Brazil the heap-leaching recovery technique on ore recovered from the weathered portion of the ore body. Production for the year reached 100 kilograms. CVRD forecasted production of 500 kilograms of gold per year to the end of the decade, when additional investment and development will become necessary.

The South African group General Mining Union Corp. Ltd. formed an association with Amira Trading S.A. for the development of its gold property at São Bento, Minas Gerais. The deposit is estimated to contain reserves of 6 million tons of ore grading 11 grams of gold per ton. Brazil's measured gold reserves were reported by DNPM to be 11.4 million troy ounces of contained gold.

Iron Ore.—Iron ore production showed a slight increase to 90 million tons, with mineral income from iron ore exports continuing in the number one position. Brazil exported a total of approximately 87 million tons of iron ore to 33 countries. This exceeded the 1983 figure by 13 million tons. The iron ore export receipts were $1.6 billion, which exceeded the 1983 figure by $146 million. The top five exporting companies were as follows: CVRD, 65.7%; Minerações Brasileiras Reunidas S.A., 13.7%; Ferteco Mineração S.A., 8.8%; Samarco Mineração S.A., 7.9%; and S.A. Mineração da Trinidade, 2.8%. The four major export markets for Brazilian iron ore were Japan, $504.9 million; the Federal Republic of Germany, $280.7 million; Italy, $112.8 million; and France, $12.2 million.

The Carajás iron ore project was, with the completion of the 890-kilometer railroad to São Luiz, inaugurated in February. The iron ore pilot plant went into operation in August with a capacity of 80,000 tons per month. CVRD expected to reach maximum capacity production of 35 million tons per year by 1990, with contract sales already negotiated for 28 million tons per year. At yearend 1984, the total Carajás iron ore reserves were estimated at approximately 17.8 billion tons grading 66% iron, which included 2.5 billion tons in the proven category. An initial investment of $5.1 billion to bring Carajás on-stream was reduced to $3.5 billion. This was attained by a reduction in the size and amount of mining and metallurgical equipment necessary to initiate production.

Nippon Steel Corp. of Japan signed a contract for 2 million tons per year of Carajás iron ore to be delivered over a 10-year period commencing in 1986. CVRD confirmed that China was interested in becoming involved in the Timbopeba iron mine, which was inaugurated in June 1984. Production forecasts point to a level of 7.5 million tons annually by 1985.

Steel.—Brazil's steel sector utilized 90% of its capacity and increased crude steel production by about 9% to approximately 16 million tons. This production figure placed Brazil eighth in the Western World. Despite important restrictions imposed on Brazilian steel exports by the United States, a 25% increase was achieved. Brazil exported 6.5 million tons of steel valued at $1.71 billion in 1984. Exports in the form of manufactured products alone rose 60%, while domestic consumption of all steel products rose 15%.

Manganese.—The manganese production of 1.9 million tons almost matched the figure for 1983. Indústria e Comércio de Minérios S.A. (ICOMI) continued to be the largest producer. CVRD continued to increase its production of electrolytic manganese from the Igarape Azul Mine in the Carajás region. The Igarape Azul deposit contains estimated reserves of 65 million tons including 11 million tons of 42% manganese.

CVRD began experimenting with manganese ores from the Corumbá mineral province, Mato Grosso, and the Carajás region. They blended Corumbá ore, rich in iron, sodium, and potassium, with Carajás ore, rich in alumina, in an effort to find a product that would be viable on the domestic market.

Bethlehem Steel Corp. of the United States, a partner for 35 years in the Serra do Navio Amapa joint venture, sold its 49% interest for $12 million to Cia. Auxiliar de Empresas de Mineração (CAEMI). The mine is now under the control of ICOMI, a subsidiary of CAEMI.

Nickel.—Metallic nickel content of ferronickel production rose approximately 18% over that of 1983 to about 12,700 tons. Major company production levels were as follows: Empresa de Desenvolvimento de Recursos Minerais S.A., 6,900 tons; Tocantins, 3,500 tons; and Morro do Níquel Ltda., 2,300 tons.

Tocantins, the only producer of electrolytic nickel in Latin America, plans to double its capacity to 10,000 tons per year, at a cost of $30 million. Caraíba Metais S.A. Indústria e Comércio plans to produce, as a byproduct of copper production, 700 tons of nickel sulfate in 1985, 950 tons in 1986, and 1,100 tons in 1987.

Tin.—Brazil's tin production rose rapidly in 1984, putting it in fourth place in world

production and ahead of Bolivia for the first time. Smelter production was in excess of 18,000 tons, about 42% above the 1983 figure. Paranapanema S.A. Mineração, Indústria e Construção was by far the largest producer with 71% of the total.

Brazil has no plans to become a member of the International Tin Council, but it does plan to curtail the rate of increase of tin production in 1985 to alleviate pressure on the international market.

Titanium.—CVRD commenced pilot plant production of titanium oxide (TiO_2) from its anatase deposit at Tapira, Minas Gerais. The mine has measured reserves of 350 million tons grading about 20% TiO_2.

Titanio do Brasil is expanding its production capacity from 50,000 tons per year of ilmenite by 1987 and installing equipment designed to recover 15,000 tons of zirconite as a byproduct. The mine at Matarca, Pernambuco, has reserves of 2.8 million tons containing 57% TiO_2, accounting for approximately 92% of Brazil's ilmenite reserves.

Zinc.—Brazil's zinc production increased by 7% to about 106,900 tons. Cia. Mineira de Metais (CMM) produced 64,750 tons, Cia. Paraibuana de Metais (Paraibuana), 29,400 tons, and Cia. Industriel e Mercantil Inga S.A. (Inga), 12,300 tons of the total production.

Mineração Morro Aguda S.A., whose mine is at Paracatu, Minas Gerais, came under new ownership in 1984. It was taken over by the three major zinc producers, CMM, Paraibuana, and Inga, for $12 million with all having equal shares. The Paracatu deposit has measured reserves of 13.6 million tons grading 5.17% zinc and 1.48% lead. At full capacity, it is expected to produce 21,500 tons of zinc and 7,000 tons of lead per year.

NONMETALS

Diamond.—Two diamond producers expanded their operations and, correspondingly, increased diamond production. Mineração Tejucana S.A. increased industrial diamond production from 10,400 to 52,100 carats per year, and Cia. Minera Morro Vermelho Ltda. opened a mine in Nortelandia, Mato Grosso, that will produce 540 carats of industrial diamonds and 4,600 carats of gem diamonds per year.

CPRM put up bids for various areas for diamond exploration at Piata and Varique in Bahia, Coromandel in Minas Gerais, and Tibage in Paraná. Domestic production for 1984 was estimated at 550,000 carats with 60% being industrial diamonds and the remainder being of gem quality.

Phosphate Rock.—Phosphate rock concentrate production was approximately 3.9 million tons, which was 20% greater than the figure for 1983. Domestic consumption for the same period increased 28%, from 3.3 million tons to 4.3 million tons. Phosphoric acid production was 661,000 tons, up 13% over the figure for 1983.

Brazil's largest producer, Fertilizantes Fosfatados S.A. (FOSFÉRTIL), a subsidiary of PETROBRÁS, is negotiating with Banco Nacional do Desenvolvimento Económico e Social and the International Bank for Reconstruction and Development for funds to expand its phosphoric acid plant at Uberaba, Minas Gerais. FOSFÉRTIL also is planning to expand its phosphate mine in Tapira, Minas Gerais, at a cost of about $45 million.

Goiás Fertilizantes S.A. (GOIÁSFERTIL), which produces 20% of national production, announced plans to expand its capacity from 620,000 to 1.2 million tons per year over the next 2 years. GOIÁSFERTIL is developing the technology for the recovery of fine phosphate (5 micrometers) from rejects.

Quartz.—Brazil circulated a national plan for quartz production among various research organizations. The plan called for an investment of $21.5 million to enable Brazil to obtain the technological capacity to produce cast quartz, synthetic quartz, and silicon. As of 1984, Brazil has about 90% of the world's reserves of quartz. The largest reserves are in the States of Minas Gerais and Santa Catarina, with smaller reserves in Bahia and São Paulo.

MINERAL FUELS

Coal.—Coal production reached 7.2 million tons, which was 14% greater than that of 1983. Steam coal production was about 6 million tons while metallurgical coal attained an output of approximately 1.2 million tons.

In December, the Fontanella Mine near Criciuma, Santa Catarina, began producing 100,000 tons of steam coal per month. It is coal without a market because the mine was developed to supply the Jorge Lacerda IV thermoelectric plant, which will not begin generating electricity until 1989.

Late in 1984, CPRM announced the discovery of three coal deposits in Rio Grande do Sul that could permit Brazil to produce high-quality coking coal within 3 or 4 years. The three deposits are Morungaba, Chico

Loma, and Santa Terezinha, and combined contain inferred reserves of 2.5 billion tons of metallurgical coal. Of the total reserves, 40% are considered to be reject. CPRM estimated that it would cost $80 million to develop a coal mine that could produce 1.2 million tons per year of coal yielding 500,000 tons of coke.

At yearend, Brazil's total coal reserves were estimated at 22 billion tons. To give greater incentives for production, a Government decree was signed in 1984 allowing equipment to be imported duty free for use in the coal sector.

Natural Gas.—Natural gas production reached 173 billion cubic feet, which exceeded that of 1983 by 22%. A number of major gas strikes during the year helped to boost Brazil's reserves of recoverable natural gas. In December, the biggest strike of the year was recorded at the Lagoa Suruaca onshore oil and gas field in the State of Espírito Santo. The development well tested 14 to 18 million cubic feet of nonassociated gas per day. PETROBRÁS stated that this was the largest gas flow recorded to date in Brazil.

PETROBRÁS confirmed a new discovery gas well in the region of Juruá in upper Amazonia. The well displayed a daily flow rate of 7 million cubic feet per day. Proven gas reserves at Juruá were determined to be between 247 and 353 billion cubic feet, with potential reserves figured at about 4.24 trillion cubic feet. Additional important gas strikes occurred in northeast Bahia, and in the Campos Basin.

A natural gas pipeline from the Campos Basin receiving terminal to Greater Rio de Janeiro was to be inaugurated early in 1984, but a jurisdictional squabble between PETROBRÁS and the State of Rio de Janeiro Gas Co. postponed the inauguration until June.

Petroleum.—According to PETROBRÁS, production of petroleum was 169 million barrels. This was a 37% increase over the figure for 1983. The average production was 462,000 barrels per day compared with 339,000 barrels per day for 1983. On June 28, 1984, Brazil passed the milestone of 500,000 barrels per day. This production mark had been scheduled for late 1984. Upon reaching the single-day milestone, Brazil moved ahead of Argentina into third place in Latin America behind Mexico and Venezuela. In October, Brazil reached its peak daily production for the year of 540,000 barrels. PETROBRÁS projected a 600,000-barrel-per-day target by mid-1985.

Petroleum imports decreased to approximately 237 million barrels, which was about 11% below that of 1983. Petroleum derivative imports showed a 53% decrease from the figure for 1983, while petroleum derivative exports increased 53% for the same period.

PETROBRÁS extended the world's record water depth for a production well to 410 meters (1,345 feet) in the Campos Basin. Petrobrás Internacional S.A., the services export subsidiary of PETROBRÁS, signed a significant agreement with the West Engineering Group of Norway to begin prospecting for oil in the deep waters of the North Sea. It is hoped that by this association, recovery techniques will be developed and acquired by PETROBRÁS for subsequent usage in the deep waters of the Campos Basin. The Campos Basin accounted for 57% of Brazil's total petroleum production in 1984.

Uranium.—Petróleos Fertilizantes Brasileiro S.A. signed an agreement for the development of the Itatata deposit. It is a large uranium-rich phosphate deposit at Santa Quiteria, Ceará. The total measured reserves of uranium at yearend were approximately 301,500 tons, of which 91,200 tons was from the Itatata deposit.

NONMINERAL ENERGY SOURCES

Alcohol.—Brazil produced approximately 9.2 billion liters (2.4 billion gallons) of alcohol, almost entirely ethanol from sugar cane, in 1984. For the same period, domestic consumption of alcohol was approximately 9.4 billion liters (2.5 billion gallons). The 1984 production was approximately 15% above the estimated figure for 1983. Since 1979, when the program was initiated, to yearend 1984, Brazil produced almost 1.8 million alcohol-powered automobiles. The engines use a mix of 20% anhydrous alcohol and 80% gasoline. In 1984, through the use of gasohol, Brazil conserved an estimated 12.8 million barrels of gasoline.

Hydroelectric.—The Itaipu hydroelectric project, on the Parana River between Brazil and Paraguay, transmitted its first electric power in October. By 1990, the powerplant will have an output of 12.6 billion watts. At yearend, the cost had risen to an estimated $15.3 billion. The Tucurui hydroelectric project, on the Rio Tocantins River, 300 kilometers south of Belem, Pará, was inaugurated in November. When the powerplant reaches full capacity in 1990, it will have a maximum output of 7.9 billion watts.

---

[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Brazilian cruzeiros (Cr$) to U.S. dollars at the rate of Cr$1,848 = US$1.00 as an average for 1984.

☆U.S. GOVERNMENT PRINTING OFFICE: 1986-491-457:20267